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A DC Electric Field Meter was purchased and assembled. This instrument will allow the measurement of the electric field produced near the earth's surface during blowing snow and blowing sand events. These measurements will in turn aid in the quantification of the effects of electrostatic forces on blowing snow and blowing sand particles; leading to better understanding and control of blowing snow and blowing sand and consequent drift formation.

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FINAL PROGRESS REPORT

J.D. Dent

May 28, 1996

U.S. ARMY RESEARCH OFFICE

contract number: DAAH04-94-G-0409

Montana State University

DC Electric Field Meter for Project: Microstructural Changes in Snow During Equitemperature Metamorphism

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The acquisition of a portable DC electric field meter to measure the electric field produced by a charged surface significantly enhances the ability of the snow study group at Montana State University to study electrical effects in snow. Forces between a falling or drifting snow particle and the ground determine how that particle falls, where it lands, and how it bonds to the surface. Saltation trajectories in drifting snow are strongly influenced by electrostatic forces. Where and how snow drifts form are in part a consequence of this electrostatic force. How snow crystals land and then bond to the snow surface and ultimately how the snowpack evolves depends on this force. These processes and more are dependent to some degree upon the electrostatic forces that can now be characterized by measurements with the DC electric field meter.

In particular, MSU's current project investigating the physical and thermodynamic properties of the snowpack, benefit by being able to include electrostatic forces in its analysis along with the other thermo-mechanical forces at work at the surface of the snowpack. In addition, snow accumulation patterns (drifting) are also a primary influence on how the physical characteristics of the snowpack evolves. As for drift formation itself, with a better understanding of the forces involved, itmay be possible to determine methods (some possibly based on electrostatic forces) to minimize formation of snow drifts in critical locations and possibly even mitigate the formation of ice on roads. Another project that will be benefitted by studying electrostatic forces is the interception of falling snow by trees. Evaporation rates and hydrologic forecasts are critically dependent upon how much snow reaches the ground and how much is remains suspended in trees. Electrostatic forces may prove to be significant in this process. Finally it is hypothesized that the electric field produced by blowing snow could be disrupted by people or machines traveling over the snow surface. The amount and length of time of this disruption is unknown, but measurements of the electric field may possibly determine how long ago and how large a vehicle may recently have passed by a certain location. Furthermore, the uses of this instrument are not confined only to a blowing snow environment, but are also directly applicable to blowing dust and sand environments which are also known to generate significantly charged surfaces. It is not certain as to what the threshold conditions are at which measurable electric fields are produced, so that the range of conditions in which electrostatic forces are significant is unknown.

The DC electric field meter provides MSU another instrument capable of providing data on the physical conditions applicable to the study of snow processes. Montana State University will employ the instrument along with other instrumentation at two established remote field sites that are used to study blowing snow and snow cornice formation, internal snowpack thermomechanical processes, and snow avalanche dynamics. To these facilities the field meter will provide significant new capability to monitor electrostatic forces as it affects the processes being studied.

Because of difficulty in finding a manufacturer of this instrument, the instrument has only just been delivered As a consequence only calibration and testing of the instrument has been carried out. It is anticipated that the instrument will be put in use for the next winter field season. No publications have yet been written and no inventions were produced.